STOPPING WATER POLLUTION AT ITS SOURCE

MISA

Municipal/Industrial Strategy for Abatement

Economic Information Needs and Assessments for Developing MISA Monitoring and Abatement Requirements

March 1987

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Ontario Ministry of the Environment

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Municipal-Industrial Strategy For Abatement (MISA)

ECONOMIC INFORMATION NEEDS AND ASSESSMENTS FOR DEVELOPING MISA MONITORING AND ABATEMENT REQUIREMENTS.

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ABSTRACT

The pollution monitoring and abatement requirements on industries and municipalities which are likely to result from the Municipal-Industrial Strategy for Abatement (MISA) programs may be costly to achieve. Consequently, it is important to design the MISA regulations so that they will be efficient, effective and to the extent possible, fair. To assist in this design process, an economic component to MISA has been initiated to determine the economic implications of the MISA programs before they are implemented. Specifically, the economic investigations will provide:

- a clear indication of the potential costs and other economic consequences of the Regulations and requirements that will be proposed.

- estimates of the economic disruptions (if any) to firms, industrial sectors, municipalities or the provincial economy that could result from implementing MISA requirements.

- determinations of the least-cost combinations of technologies or systems to achieve specific monitoring and abatement objectives in plants or industrial sectors.

- information that can be used to design more effective policies or programs to control sewer uses by industrial dischargers.

- information that can ultimately be used to estimate the beneficial consequences of monitoring and emission levels requirements.

The economic program begins with assembling industrial profiles for each sector which will include physical and economic data in each sector as well as historical financial ratios, current trends, and forecasts of future market production and consumption.

Next, studies will be carried out to estimate the costs of the proposed monitoring requirements for each sector. The results of these studies will aid Ministry staff in determining the most cost effective methods of monitoring for selected contaminants.

Abatement technologies to achieve MISA objectives will be identified and analyzed for each industrial sector. Consultants will be employed in order to determine abatement efficiencies and costs of each technology, estimate the costs of achieving different emission levels and to identify "best available technologies". These results will aid Ministry staff in determining the most cost effective methods of abatement.

A fourth set of studies which will utilize information provided by previous work, will involve assessments of the economic impacts of requirements on firms and sectors. These studies will be carried out to determine reactions of firms to alternative monitoring scenarios and effluent limit scenarios.

Macro-economic assessments will make up a fifth component of the economic program. Estimates of the economic impacts of implementation costs on the provincial economy using existing or easily modified econometric models will be produced.

Since an important objective of the MISA program is to develop sewer use control strategies which will prevent discharge of toxic and refractory materials into sewer systems, a further economic study will review the status of sewer surcharge programs and practices with the intent to design more effective sewer surcharge programs for municipalities.

Finally, to provide further justification for an effluent limit Regulation, risk-cost assessment evaluations will be carried out for sectors which are expected to have especially large cost burdens.

RÉSUMÉ

Le respect des exigences en matière de surveillance de l'environnement et de lutte contre la pollution qui seront vraisemblablement imposées aux industries et aux municipalités dans le cadre des programmes issus de la Stratégie municipale et industrielle de dépollution (SMID) risque de s'avérer coûteux. Par conséquent, il est important que les règlements relatifs à la SMID soient efficaces, et, autant que possible, équitables. Pour ce faire, une composante économique a été ajoutée à la SMID pour déterminer le coût de ses programmes avant leur mise en application. Les études économiques doivent :

- donner une idée précise des coûts potentiels et autres répercussions économiques des règlements et autres exigences qui seront proposés;

- donner une estimation des perturbations économiques que risquent de subir les employeurs, les secteurs industriels, les municipalités ou la province du fait de la mise en application de la SMID;

- proposer les combinaisons de techniques et de systèmes les plus abordables parmi celles qui permettraient d'atteindre des objectifs précis de surveillance et de dépollution dans les usines ou les secteurs industriels;

- fournir des renseignements utiles pour élaborer des politiques et des programmes plus efficaces pour surveiller les rejets de déchets de sources industrielles dans les égouts;

- fournir des informations susceptibles d'être utilisées pour évaluer les effets positifs de la surveillance et de la limitation des émissions.

Ces études économiques débuteront par une synthèse des caratériatiques des différents secteurs. Cette synthèse rassemblera les données physiques et économiques qui leurs sont propres, de même que leurs résultats financiers passés, leur évolution actuelle et des prévisions sur la production et la comsommation.

Ensuite, des études seront entreprises pour estimer, dans chaque secteur, le coût de l'application des exigences en matière de surveillance. Les résultats de ces études aideront le personnel du ministère à déterminer les méthodes les plus abordables de surveillance de certains polluants.

Les techniques de dépollution permettant d'atteindre les objectifs de la SMID seront identifiés et analysés pour chaque secteur industriel. Des experts-conseils seront embauchés pour calculer l'efficacité et le coût de chaque technique, pour estimer les frais qu'entraîne le respect des différentes limites d'émissions et pour identifier "les techniques les plus évoluées". Ces résultats aideront le personnel du ministère à identifier les techniques de dépollution les plus abordables.

Une quatrième série d'études, qui utilisera les renseignements tirés des travaux antérieurs, portera sur l'évaluation des répercussions économiques des exigences à respecter par les entreprises et les secteurs. Ces études serviront à prévoir la réaction des entreprises aux scénarios de rechange en matière de surveillance et de limitation des rejets.

Les études macro-économiques constitueront la cinquième partie de la composante économique de la SMID. À partir de modèles économétriques existants ou facilement adaptables à ces études, on procédera à l'évaluation des répercussions du coût de mise en oeuvre sur l'économie de la province.

Comme l'un des principaux objectifs de la SMID est de créer des stratégies de contrôle de l'utilisation des réseaux d'égouts visant à empêcher qu'y soient déversés des produits toxiques ou réfractaires, une autre étude économique examinera, sous l'angle d'une amélioration possible, les pratiques de surfacturation de l'utilisation des égouts par les industries dans les municipalités.

Enfin, pour mieux justifier un règlement de limitation des rejets, des évaluations des risques et du coût seront effectuées pour les secteurs dans lesquels on prévoit des frais particulièrement élevés.

le 13 mars 1987

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INTRODUCTION

The economic component of the Ontario Municipal-Industrial Strategy for Abatement (MISA) initiative is described in this paper. The MISA initiative is intended to achieve the "virtual elimination of toxic contaminants in municipal and industrial discharges into waterways" (Ontario Ministry of the Environment, June 1986:7).

The requirements that will result from the MISA programs are far-reaching and will likely be costly to achieve. Money and effort that will be required to implement the MISA Regulations and requirements will have to be diverted from other beneficial uses in government and private industry. Economic assessments will indicate clearly what will have to be given up in order to achieve MISA objectives. Economic principles can also be used to design programs that are efficient, fair and effective at inducing polluters to implement their abatement programs within specified deadlines.

In addition, economic assessments and analyses are required for the following reasons and purposes:

1. to define what is meant by the term "Best Available Technology, Economically Achievable" as specified in the MISA White Paper (Ontario Ministry of the Environment, June 1986),

2. to determine the magnitude and the distribution (among governments, industrial sectors and municipalities) of the direct costs and other economic consequences of the proposed MISA Regulations and requirements,

3. to identify the potential beneficiaries of the expenditures that will be made to implement MISA requirements,

4. to identify least-cost combinations of technologies or systems to achieve specific monitoring and abatement objectives,

5. to predict how firms and municipalities might react to MISA Regulations and requirements,

6. to design abatement programs for specific emitters (such as particular industrial sectors, firms or municipalities) that are least-cost, fair and effective, and

7. to design programs that will induce emitters to implement programs rather than expend money and effort to delay and forestall implementation.

The present paper is intended to help personnel within the Ministry of the Environment, officials in other Ontario and Federal Government agencies, consultants, and interested members of the public understand how economic information will contribute to the planning and implementation of the MISA program. A description of the specific economic analyses to be undertaken and information to be assembled will also be presented in this paper. The expected relevance and utility of the results of these economic analyses to MISA implementation processes will be discussed.

Before beginning these discussions, the objectives, components, timing and other elements of the MISA initiative are described briefly in the next section. This review, which is based on the MISA White Paper, is presented so that the reader can clearly follow any references to specific components of the MISA program that will be made throughout this paper.

Finally, economic assessments are an integral part of the MISA program and are being initiated at the beginning of the effort. In this way, relevant information on the economic consequences will be available when Regulations concerning monitoring and effluent limits are developed. The information generated by these economic assessments can also be used to respond to complaints and allegations from regulated firms or sectors about any adverse economic effects of the proposed requirements.

THE MISA PROGRAM

The MISA program consists of three broad initiatives:

1. Development and promulgation of Regulations which specify monitoring and effluent limits that are based on the "best available control technology (BAT) that is economically achievable" (MOE, June 1986:2).

2. Development of effluent limits based on water quality impacts.

3. Implementation of abatement and enforcement activities to ensure that specific abatement program schedules and deadlines are met.

The MISA program encompasses 200 of Ontario's 300 direct industrial dischargers together with 400 municipal sewage treatment plants which receive wastewater from almost 12,000 industrial plants (MOE, June 1986:3). The program is being implemented by means of the following steps:

1. Identification and monitoring for toxic substances and conventional contaminants in municipal and industrial effluents to build up a comprehensive data base.

2. Consultation with industrial and municipal representatives.

3. Specification of limits for contaminant concentrations (e.g. mg/l) and loadings (e.g. kg/day or kg/day/production unit) in effluents. As noted, two approaches are being applied to arrive at these limits:

   - determination of loadings that can be achieved by specific abatement technologies (e.g. BAT);
   - determination of loadings that are required to achieve ambient water quality objectives in receiving waters.

4. Sensitive and confined aquatic environments may require more stringent limits to protect them than are provided by BAT requirements. Six areas are being studied to determine effluent limits that are required to achieve water quality goals:

   - St. Clair River;
   - Kaministikwia River (Thunder Bay);

- St. Mary's River (Sault Ste. Marie);
- Toronto Harbour;
- St. Lawrence River at Cornwall;
- Grand River.

5. Codify monitoring and effluent requirements in Regulations, control orders, or requirements and directions under the Ontario Environmental Protection Act or the Ontario Water Resources Act.

6. Conduct public participation programs during the course of developing objectives and Regulations.

7. Application of prosecutions and other appropriate enforcement instruments to violations where warranted after Regulations are in place.

The monitoring and effluent limits requirements will be developed for municipal waste-water treatment plants and for waste-water discharges from the Industrial Sectors listed in Table I.

The timetable for implementing these activities is shown in Figure I. As indicated, Regulations will first be promulgated for the petroleum and organic chemical industries. According to these deadlines, the monitoring Regulation for petroleum and organic chemicals is scheduled to be promulgated in April 1987. The first abatement Regulation, again for the petroleum and organic chemicals sectors, is scheduled to be in place by January 1988.

TABLE I

PRELIMINARY LISTING OF INDUSTRIAL SECTORS, FIRMS, AND ESTABLISHMENTS WHICH WILL BE SUBJECT TO MISA REQUIREMENTS

Petroleum Refining

Esso Petroleum Canada, Sarnia
Petro-Canada, Mississauga
Petro-Canada Products Limited, Oakville
Petrosar, Sarnia
Shell Canada Ltd., Sarnia
Suncor, Sarnia
Texaco Canada Ltd., Nanticoke

Organic Chemicals and Synthetics

B.F. Goodrich, Niagara Falls
Bakelite Thermosets Ltd., Belleville
BCL, Cornwall
Borg-Warner Chemicals Limited, Cobourg
Canadian Oxy Chemicals Ltd., Fort Erie
Cornwall Chemcials/C.I.L., Cornwall
Celanese Canada Ltd., Ernestown Twp.
Courtaulds Canada Ltd., Cornwall
Domtar Chemicals Inc., Orillia
Dow Chemical Canada Ltd., Sarnia
Dupont Canada Inc., Kingston
Dupont Canada Inc., Maitland
Dupont Canada Inc., Corunna
Esso Chemicals Canada Ltd., Corunna
Ethyl Canada Inc., Corunna
Allied Canada Ltd. ("Genetron" production facility), Amherstburg
Polysar Ltd., Sarnia
Reichold Chemicals Ltd., Thunder Bay
Shell Canada Ltd., Corunna
Union Carbide Canada Ltd., Corunna

Pulp and Paper

Abitibi-Price Inc. (Ft. William Div.), Thunder Bay
Abitibi-Price Inc. Iroquois Falls Mill, Iroquois Falls
Abitibi-Price Inc. (Provincial Papers Div.), Thunder Bay
Abitibi-Price Inc., Smooth Rock Falls
Abitibi-Price Inc. (Thunder Bay Div.) Thunder Bay
Beaver Wood Fibre Company, Thorold
Boise Cascade Canada Ltd., Fort Francis
Boise Cascade Canada Ltd., Kenora
Domtar Construction Materials Ltd., Thorold
Domtar Fine Papers, Cornwall
Domtar Fine papers, St. Catharines
Domtar Packaging Ltd., Trenton
Domtar Packaging Ltd., Red Rock
E.B. Eddy Forest Products Ltd., Espanola
E.B. Eddy Forest Products Ltd., Ottawa
Fraser Inc., Thorold
Great Lakes Paper Products Ltd., Thunder Bay
Great Lakes Forest Products Ltd., Dryden
James River Marathon Ltd., Marathon
Kimberly Clark of Canada Ltd., St. Catharines
Kimberly Clark of Canada Ltd., Huntsville
Kimberly Clark of Canada Ltd., Terrace Bay
MacMillan Bloedel Ltd., Sturgeon Falls
Ontario Paper Company Ltd., Thorold
Spruce Falls Power and Paper Co. Ltd., Kapuskasing
St. Mary's Paper Inc., Sault Ste. Marie
Strathcona Paper Company, Camden East Twp.
Trent Valley Paperboard Mills, Trenton

Iron and Steel

Algoma Steel Corporation Ltd., Sault Ste. Marie
Atlas Steel Company, Welland
Dofasco, Hamilton
Stelco Inc., Hamilton
Stelco Inc. Lake Erie Works, Nanticoke
Stelco Page Hersey Works, Welland
Stelco Welland Tube Works, Welland

Metal Mining and Refining

Agnico Eagle Mines Limited Silver Division, Cobalt
Algoma Steel Corp. Ltd., Wawa
Denison Mines Ltd., Elliot Lake
Dome Mines Ltd., South Porcupine
Eldorado Resources Ltd., Blind River
Eldorado Resources Ltd., Port Granby
Eldorado Resources Ltd., Port Hope
Falconbridge Ltd., Onaping Falls
Falconbridge Ltd., Falconbridge
Falconbridge Ltd. (Moose Lake), Falconbridge
Inco Ltd. (Copper Cliff Creek), Sudbury
Inco Ltd. (Crane Hill Mine), Copper Cliff
Inco Metals Company, Shebandowan
Inco Metals Ltd., Port Colborne
Inco Ltd. (Garson Mine), Sudbury
Inco Ltd. (Nolin Creek), Sudbury
Inco Ltd., Sulphur Products Div., Sudbury
Kerr Addison Mines Limited, Virginiatown
Kidd Creek Mines Ltd., Hoyle Twp., Timmins
Kidd Creek Mines Ltd., Kidd Twp., Timmins
Noranda Hemlo Inc., Marathon
Noranda Mines Limited, Manitouwadge
Pamour Porcupine Mines - Pamour Site, Timmins
Pamour Porcupine Mines Ltd., Shumacher Division, Timmins
Rio Algom Ltd. (Panel Mill), Elliot Lake
Rio Algom Ltd. (Quirke Mill), Elliot Lake
Rio Algom Ltd. (Stanleigh Mill), Elliot Lake
Sherman Mines, Temagami
Macassa Mines Ltd., Kirkland Lake

Industrial Minerals and Manufacturing

Canadian Salt Company Ltd., Windsor
Domtar Chemicals Ltd., Goderich
International Minerals and Chemicals, Dunnville
Exelon ESK Co. of Canada Ltd., Thorold
Fiberglas Canada Inc., Sarnia
Norton co., Niagara Falls
Sohio (formerly Canadian Carborundum), Niagara Falls
Washington Mills Limited, Niagara Falls

Electric Power Generation

Ontario Hydro, Tiverton
Ontario Hydro, Nanticoke
Ontario Hydro (Lakeview), Toronto
Ontario Hydro (Lambton), Courtright
Ontario Hydro (Thunder Bay), Thunder Bay

Inorganic Chemicals

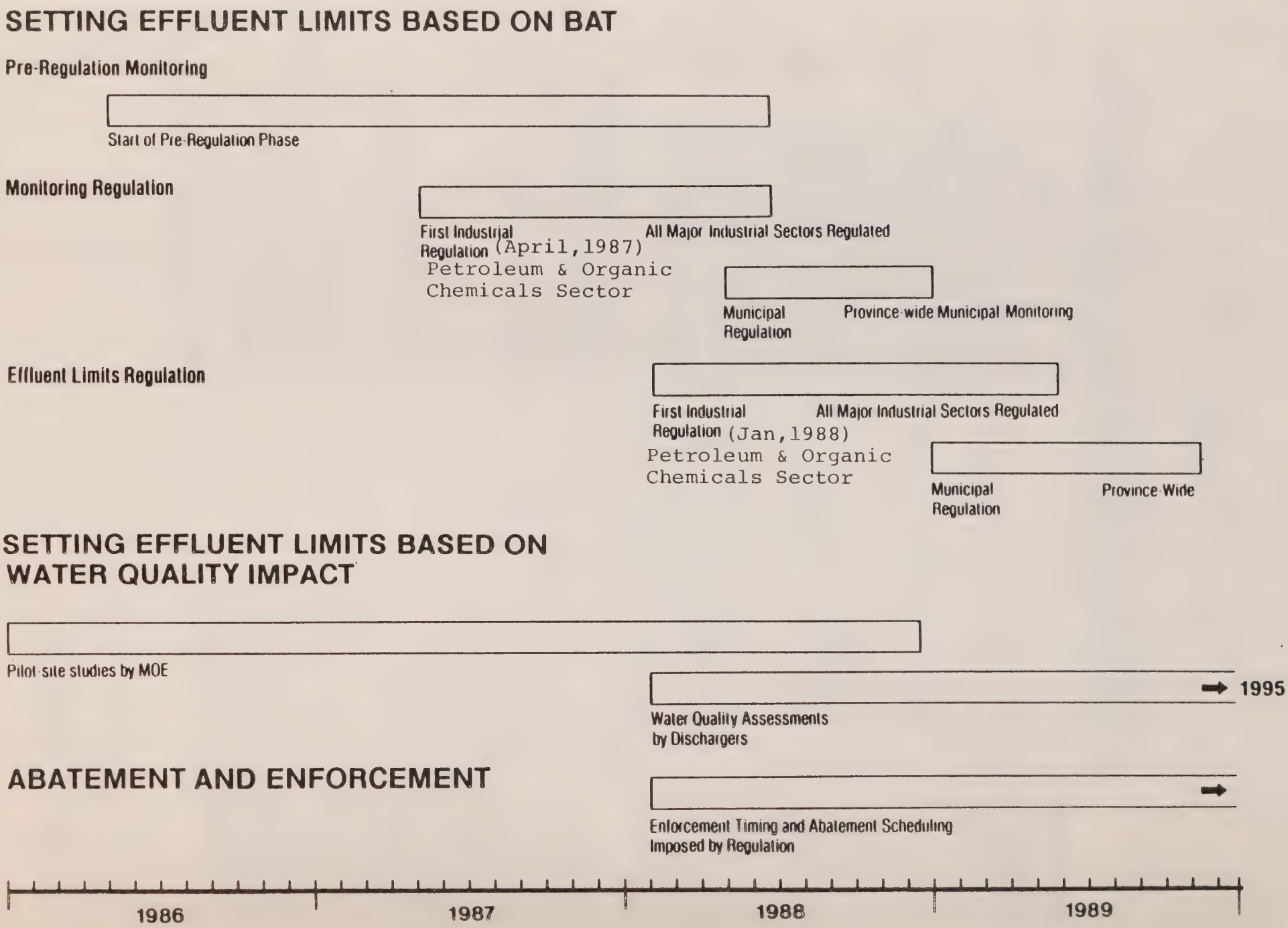
General Chemical Canada Ltd. (Soda ash production), Amherstburg
Canadian Industries Limited, Courtright
Cyanamid Canada Ltd., Niagara Falls
Nitrochem, Maitland
Norton Company, Niagara Falls

Source: Water Resources Branch,
Ontario Ministry of the Environment

Figure 1

MISA IMPLEMENTATION SCHEDULE

(MISA White Paper, June 1986)



BALANCING BENEFITS AND COSTS

The objectives of the MISA initiative have been established to achieve a high level of environmental protection with respect to hazardous contaminants. Analyses will, therefore, be undertaken to determine those combinations of technologies and programs that can achieve the proposed monitoring and effluent limits at least-cost. The analytical methods and the data needed to do this are discussed in the following section. Moreover, economic assessments of the MISA program will generate estimates of the costs of the monitoring and abatement requirements and who will bear them.

For some industrial sectors or locations, proposed Regulations or the costs required to meet them may be extremely contentious. In these cases, a modified benefit-cost assessment as described by Donnan (Mercury Pollution in the Wabigoon-English River System", January 1986) or by Downing (1984:110) can be employed to assess the beneficial consequences of proposed effluent limits and compare them with the expected costs.

It is emphasized that a benefit-cost analysis would not constitute the primary basis for decision-making concerning requirements under the MISA program. However, benefit-cost analyses which incorporate risk assessments could, for highly contentious situations, help confirm specific requirements or provide justification for taking specific actions or decisions. Development of risk and benefit information is discussed in a later section of this paper.

DEVELOPMENT OF COST ESTIMATES

An "abatement cost function" can be used to define the least-cost methods of achieving specific levels of control or abatement. Monitoring cost functions can be similarly defined.

Cost functions can be arranged to show in tabular, graphical or equation form what it will cost to achieve various degrees or levels of accomplishment, such as abatement. An "abatement cost function" shows different levels of final effluents that can be achieved at specific levels of cost.

For a detailed discussion of cost functions, see Donnan, Griffith, Glover and Dandele (in Ontario Ministry of the Environment Technology Transfer Conference Proceedings, December 1986).

An example of a tabular abatement cost function for a lime plant is shown in Table II. The table shows a set of least-cost abatement programs that were derived from a comprehensive set of abatement programs made up of combinations of "best-available technologies". Many combinations of technologies achieve identical levels of particulate reduction but at higher costs than the plans which comprise the least-cost set shown in Table II.

The total costs (in present value terms over 10 years) of reducing particulate emissions are shown along with the technologies used and the outlets in the plant to which they were applied. A graph of the costs and the percent reductions in particulate are shown in Figure II.

Empirical abatement or monitoring cost functions are necessary to determine:

- the explicit costs of different technology-based standards that will be proposed in the course of the MISA program,

- levels of abatement where costs increase disproportionately to the improvements that are achieved in terms of effluent loading reductions,

- the financial impacts on firms and sectors that are subject to regulatory requirements.

Under the MISA program, monitoring requirements and the discharge loading limits or objectives will be determined initially on the basis of technical criteria. Effluent limits will be set based on what can be achieved by the Best Available Technology. U.S. EPA definitions are cited in the MISA White Paper (pp 31-32). These definitions are summarized in Table III.

TABLE II

AN EXAMPLE OF

LEAST-COST PARTICULATE ABATEMENT PROGRAMS
FOR AN ONTARIO LIME PLANT

From "Existing Plant" to "Best Available Technology"

WATAP PLAN #	Treatment Technologies	Total Final Particulate Emissions (000 lbs/yr)	% Reduction	Outlets Affected	Years to Final Emissions	Before Tax Net Present Value of Costs and Revenues ($000)	Before Tax $/lb. Removed	Capital Costs (undiscounted) ($000)
	Existing Plant	3,120	-	-	-	-		-
2	WABL	3,097	0.74	3	1	- 63.6	0.31	∅
25	WH	2,725	12.65	5	1	- 103.4	0.03	40.0
26	WABL, WH	2,702	13.39	3,5	1	- 167.0	0.04	40.0
158	WABL, WH, DESP	2,685	13.96	3,5,14	1	- 260.1	0.07	118.3
3	EMUL	2,565	17.80	4	1	- 269.6	0.05	∅
4	WABL, EMUL	2,542	18.53	3,4	1	- 333.3	0.06	∅
7	DMF	2,261	27.52	14,15,16	1	- 338.1	0.04	75.0
27	EMUL, WH	2,170	30.45	4,5	1	- 373.0	0.04	40.0
28	WABL, EMUL, WH	2,147	31.19	3,4,5	1	- 436.7	0.05	40.0
31	DMF, WH	1,867	40.18	14,15,16,5	1	- 441.5	0.04	115.0
32	WABL, DMF, WH	1,844	40.91	3,14,15,16,5	1	- 505.1	0.04	115.0
164	WABL, DMF, WH, DESP	1,826	41.48	3,14,15,16,5	1	- 598.2	0.05	193.3
9	EMUL, DMF	1,706	45.32	4,14,15,16	1	- 607.7	0.05	75.0
10	WABL, EMUL, DMF	1,683	46.06	3,4,14,15,16	1	- 671.4	0.05	75.0
33	EMUL, DMF, WH	1,311	57.97	4,14,15,16,5	1	- 711.1	0.04	115.0
34	WABL, EMUL, DMF, WH	1,288	58.71	3,4,14,15,16,5	1	- 774.8	0.05	115.0
166	WABL, EMUL, DMF, WH, DESP	1,271	59.28	3,4,14,15,16,5	1	- 867.8	0.05	193.3
45	EMUL, DMF, LEQ, WH	1,241	60.24	4,14,15,16,17,5	2	- 905.3	0.06	290.0
46	WABL, EMUL, DMF, LEQ, WH	1,218	60.97	3,4,14,15,16,17,5	2	- 968.9	0.06	290.0
81	EMUL, DMF, WH, BGVK, INVK	1,092	65.01	4,14,15,16,5,8	3	- 3414.2	0.24	794.6
82	WABL,EMUL,DMF,WH,BGVK,INVK	1,069	65.75	3,4,14,15,16,5,8	3	- 3477.9	0.24	794.6
190	WABL,EMUL,DMF,WH,BGVK, INVK,DESP	1,051	66.32	3,4,14,15,16,5,8	3	- 3570.9	0.25	872.9
93	EMUL,DMF,LEQ,WH,BGVK,INVK	1,021	67.28	4,14,15,16,17,5,8	3	- 3608.4	0.25	969.6
94	WABL,EMUL,DMF,LEQ,WH, BGVK,INVK	998	68.01	3,4,14,15,16,17, 5,8	3	- 3672.0	0.25	969.6
142	WABL,EMUL,DMF,LEQ,WH,CORK	984	68.48	3,4,14,15,16,17, 5,8	4	- 9908.5	0.77	7790.0

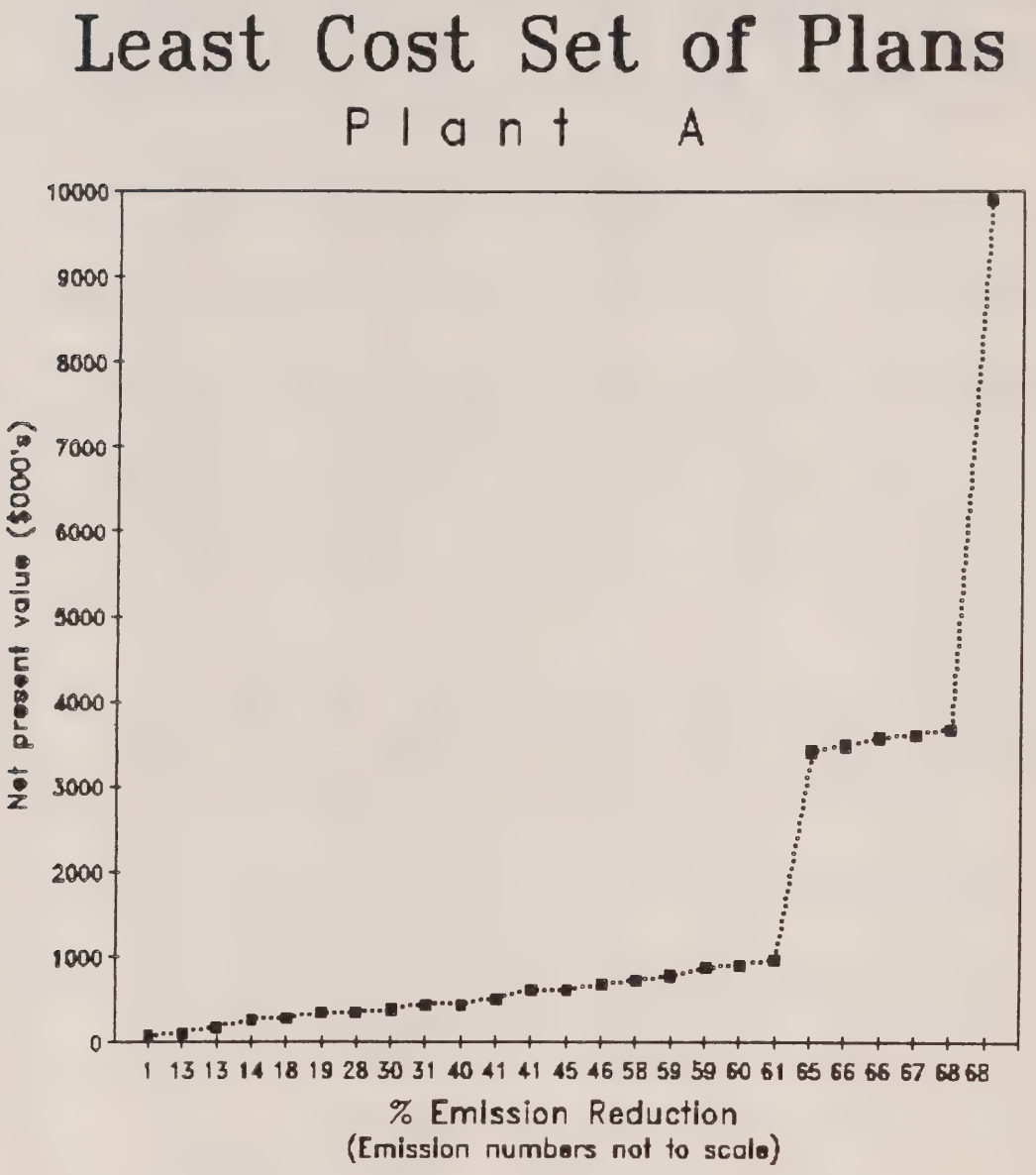
NB "WATAP Plan #" refers to the Waste Treatment Analysis Program which is used to find the least-cost set of Abatement Plans which are combinations of "treatment technologies".

Source: J.A. Donnan, C. Griffith, S. Glover and M. Dandele (Dec. 1986)

FIGURE II

ABATEMENT COST FUNCTION

Least-Cost Set of Particulate Abatement Programs for an Ontario Lime Plant



NB Graph plotted from figures in Table II.

Source: J.A. Donnan, C. Griffith, S. Glover and M. Dandele (Dec. 1986)

TABLE III

DEFINITIONS OF TECHNOLOGICAL STANDARDS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY

a) For conventional pollutants:

- Best Practical Control Technology (BPCT) that exists at a particular time.

- Best Conventional Pollutant Control Technology (BCPCT) to achieve effluent reductions beyond BPCT levels "if costs were reasonable (as determined by the U.S. EPA)".

b) For Toxic (or Priority) Pollutants:

- Best Available Technology Economically Achievable (BAT). These are technologies that are currently in place in various factories and plants and so are presumably economically achievable.

- New-Source Performance Standards (NSPS) based on Best Available Demonstrated Technology (BADT). New plants and facilities have more options for employing more efficient and less polluting processes, improved recycling of process streams and reduced water use.

c) For Industrial Dischargers into Sanitary Sewers:

- Pretreatment Standards for Existing Sources.

- Pretreatment Standards for New Sources.

Under these criteria, requirements for new sources will generally be more stringent than requirements for existing sources. This feature can have important economic implications that will be examined in the course of the MISA program development.

Unfortunately, purely technical criteria such as those cited above do not yield unique sets of objectives for the following reasons:

- control technologies for the same type of contaminants often vary from industry to industry.

- the same degree or level of control or abatement can be achieved by more than one combination of feasible control technologies.

- technical change will make some types of BAT obsolete, especially where there is a long lead time required for implementation.

A least-cost abatement cost function can, however, specify a set of technology combinations that achieves desired objectives at the lowest cost possible given available technologies. This approach avoids ambiguity and implicit value judgements inherent in technology-based criteria.

Similar cost functions can be derived for monitoring technologies. Different levels of monitoring effort will have varying costs. The more parameters that are to be monitored, and the more accuracy (e.g. lower variance) desired, the more costly monitoring will likely be. Moreover, there are likely to be different combinations of monitoring technologies that will achieve identical monitoring standards but at different costs. Development of a cost function will identify these high cost options.

Investigations will be mounted to assemble the data and information needed to construct monitoring and abatement cost functions for specific establishments or firms. The cost functions can then be used to estimate the total costs of the specific monitoring and effluent limits Regulations for each industrial and municipal sector.

A Monitoring Technology and Cost Study will be carried out in two phases. Phase I will assemble information concerning monitoring of contaminant parameters in the effluents of the Petroleum and Organic Chemical Industries. Phase II will focus on monitoring technologies for parameters relevant to other industrial sectors.

Abatement technologies and costs will be developed on an industry or sector-by-sector basis by means of an Abatement Technology and Cost Study. Again, this information will be assembled in a form and manner that will enable the estimation of abatement cost functions for each major point source establishment.

A set of computer programs developed and maintained by the Ministry of the Environment called WAste Treatment Analysis Program (WATAP) will be applied to generate abatement cost functions for individual plants. These plant-specific cost functions can be combined to produce aggregate cost functions as well as estimates of the total costs of achieving specific effluent limit objectives or technology-based requirements.

FINANCIAL AND ECONOMIC IMPACT ASSESSMENTS

Development of cost functions will help determine how to achieve effluent limits efficiently. They can also be used to determine how much cost each sector, firm or municipality will have to bear in order to implement monitoring and abatement requirements. These costs may engender complaints and allegations of undue economic disruption and even losses of employment. As noted in the MISA White Paper, even the Technology-derived effluent limits have the proviso, "economically achievable". Therefore, to determine how such costs will affect the relevant firms, municipalities, sectors and the Provincial economy, and to help judge what level of abatement is "economically achievable", the following analyses will be undertaken:

1. Assemble historical financial information about each relevant industrial sector, especially economic performance indicators that will be affected by monitoring and abatement costs. This information will be gathered by means of Industry Profiles Studies. Petroleum and Organic Chemicals will be the first such industrial sectors to be examined.

2. Conduct financial impact assessments of potential costs on each sector and on major firms. Using data assembled from the Industrial Profiles, the following analyses can be undertaken:

    a) Calculate changes in performance indicators and ratios as a result of expected monitoring and/or abatement costs and compare with historical firm and industry figures.

    b) Determine the ability of firms to pass on cost increases as higher prices of relevant goods and services.

    c) Assess potential increases or decreases in employment that might result from monitoring or abatement requirements.

3. Commission econometric assessments of the macroeconomic effects of aggregated abatement and monitoring costs on the provincial economy.

Figures III and IV illustrate how economic assessments fit into the development of monitoring and effluents limits Regulations.

Figure III

DEVELOPMENT OF MONITORING REGULATION FOR PETROLEUM AND ORGANIC CHEMICAL INDUSTRIES

(ECONOMIC COMPONENTS IN CAPITAL LETTERS)

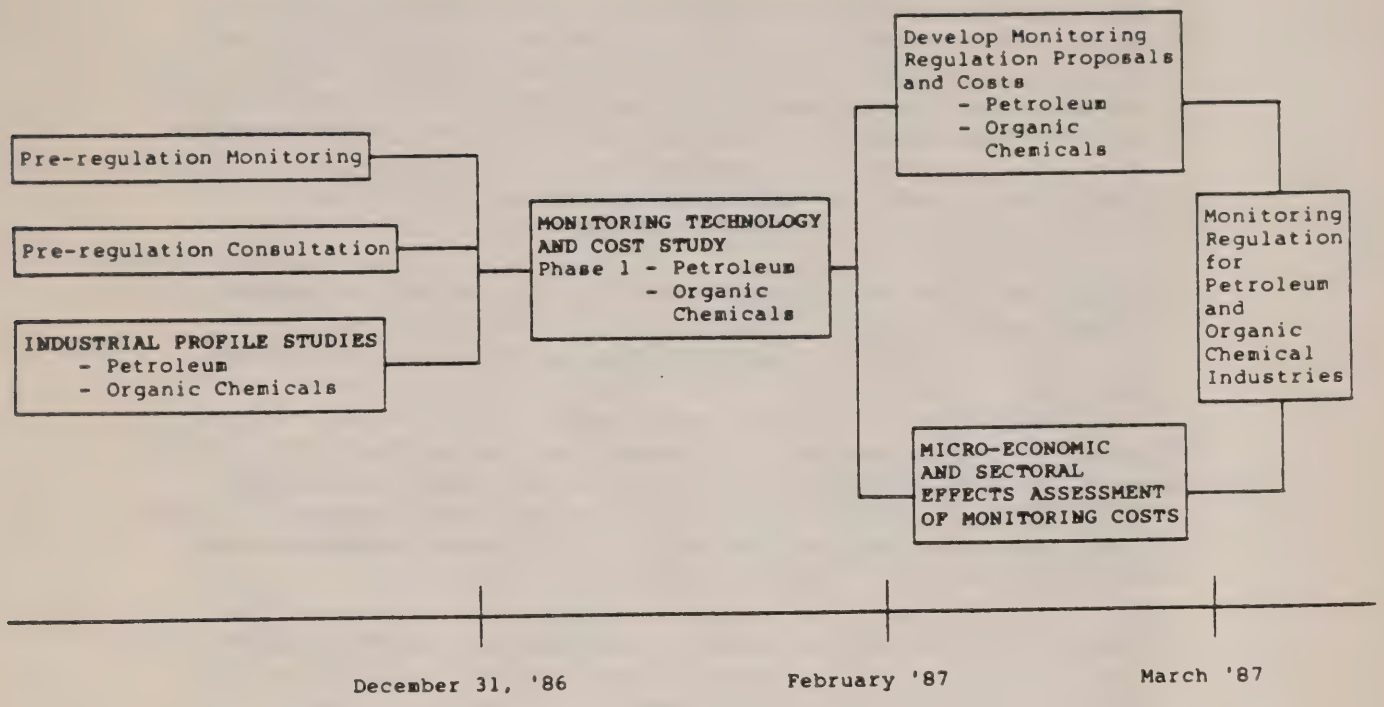
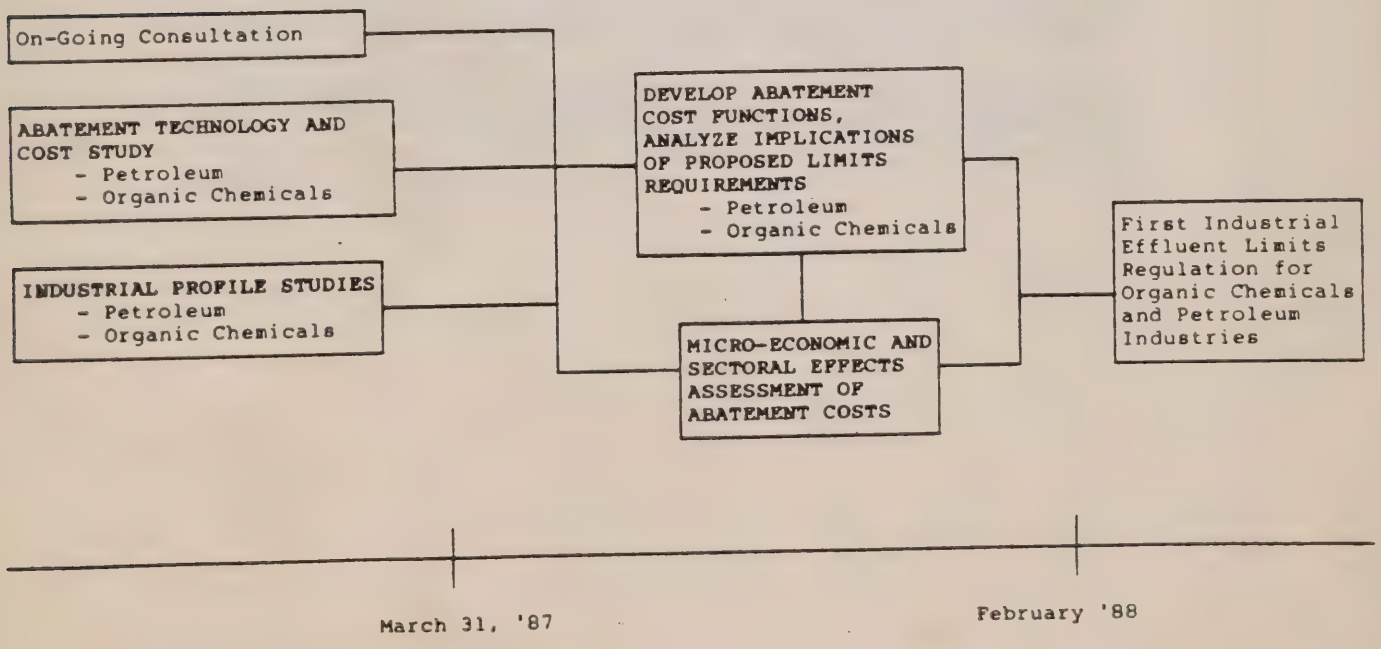


Figure IV

DEVELOPMENT OF EFFLUENT LIMIT REGULATION FOR PETROLEUM AND ORGANIC CHEMICAL INDUSTRIES

(ECONOMIC COMPONENTS IN CAPITAL LETTERS)



POLICY DESIGN AND ASSESSMENT

An important objective of the MISA program is to develop sewer use control strategies which will prevent the discharge of toxic and refractory materials into sewer systems. Sewer use by-laws and other "command and control" regulatory requirements for pretreatment by designated firms and plants are being studied and their application in other jurisdictions is being reviewed.

Many cities in Canada and the U.S. have implemented sewer surcharges to help cover the extra cost of treating large volume, "extra-strength" industrial wastes. Sims (1979) and others (Penman, Feb., 1974; Damakeas, Feb., 1974) have shown that firms respond to sewer surcharges by implementing reductions in water use, pretreatment technologies and more efficient operations in order to avoid extra surcharges. These programs are described briefly by Peat Marwick and Partners (July, 1983: III-11).

There have been no recent studies of sewer surcharges in Canada to determine the extent to which they are applied, their effectiveness at deterring waste discharges, or the prospects for designing and implementing more effective sewer surcharge programs.

Consequently, an intensive examination of the status of sewer surcharge programs in Canada would be especially timely and would contribute to the evaluation of sewer use control options. It would be particularly useful to compare compliance achieved in municipalities with sewer surcharges with compliance indicators from communities without sewer surcharges. Such a study would also reveal insights that can help in designing more effective surcharge programs as well as confirming the effectiveness of this policy compared with other sewer use control policy options.

A Sewer Surcharge and Sewer Use By-Law Study is, therefore, proposed as part of the economic component of MISA.

RISK ASSESSMENT AND BENEFIT INFORMATION DEVELOPMENT

A major component of the MISA initiative involves water quality impact studies to develop site specific effluent limits objectives. Water bodies with different beneficial uses (e.g., drinking water supply, fish habitats, etc.) are being studied.

If control costs for sectors or firms to achieve MISA requirements are very high and will potentially have severe financial impacts, it will be prudent to assemble information that can ultimately be used to describe, quantify and, perhaps, value the beneficial consequences of the abatement programs.

These beneficial consequences include reduced health risks, reduction in fish kills and increased aesthetic satisfaction by the public. Data and information that will permit estimation of some of these beneficial consequences can be collected as part of the field studies at the pilot sites. This information would include data on specific uses such as water withdrawals, swimming, recreational fishing, boating, waterfront property development, etc.

In addition, information relevant to risk assessment estimation can be collected. This information would include:

a) Dose-response relationships for specific chemical parameters.

b) Populations exposed.

c) Exposure pathways.

d) Exposure times where relevant.

Water quality assessment studies which are being initiated in sensitive and confined aquatic environments can be expanded to produce water use data and other information relevant to risk assessment. Alterations in these studies would involve a very modest additional cost.

CONCLUSIONS

The usefulness of the information developed in these investigations will extend far beyond the MISA program. For example, such information will be useful in the development of Remedial Action Programs on the designated areas of concern around the Great Lakes.

The industrial profile data and the analytical techniques employed will also be applicable to the development of specific Ministry orders by regional personnel. Information on abatement technologies and costs should also be helpful to the Environmental Approvals and Land Use Planning Branch in future assessments of applications for certificates of approval.

Finally, the industrial profile information, together with the abatement technologies and cost estimates, will be important information in implementing the financial assurance requirements of Bill 112, which received Royal Assent on December 18, 1986. This amendment is now called the Environmental Enforcement Statute Law Amendment Act, 1986 and will appear as Chapter 68, Statutes of Ontario, 1986. The Ministry can now require that financial assurance be deposited when projects or abatement programs are approved or ordered by the Ministry. Financial assurance, which can take the form of cash deposits, letters of credit, personal bonds, surety bonds or bonds guaranteed by the government of Canada or a province, will act as an incentive to polluting companies to comply with environmental protection requirements. This requirement will be extremely useful in the enforcement of the MISA program.

The economic assessments, together with the other components of the MISA program, will help to integrate the scientific, engineering, economic and biological assessments of the various monitoring and abatement programs and generate policy-relevant information which can be useful in making choices and decisions. These efforts will also indicate to those concerned about the economic and social impacts of the MISA program that evaluations are being made to ensure that the program is being implemented in a manner that is effective, efficient and fair.

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